## OBSERVATIONS ON THE GREAT LAKES.

### REPORTS FROM VESSELS.

The Lake Marine Section of the Forecast Division has received reports from the captains of 40 vessels navigating the Great Lakes. The following miscellaneous items are extracted from their reports:

Capt. W. S. Shay, steamship *Governor Smith*, 20th, 1 a. m., Lake Michigan, a violent north-northeast gale and very heavy sea.

Capt. J. W. Morgan, steamship *Australia*, on St. Marys River, Mich., 27th, reports snow squalls from 3 a. m. to noon.

Capt. S. Langell, steamship *Zealand*, 27th, Lake Superior, reports heavy snowstorm from 4.30 to 6.15 a. m., the snow falling so heavily unable to see consort at a distance of 600 feet; the wind was blowing very hard at the time with very heavy sea.

Capt. E. T. Rattray, steamship *Specular*, 16th, on St. Marys River, Mich., and 16th on Lake Michigan, heavy squalls with thunder, rain, and hail; the storm seemed to come from all points of the compass.

Capt. Edward Mooney, steamship *Wa-Wa-Tam*, 3d, Lake Erie, northern lights from 9.50 p. m. until midnight. 30th, Lake Michigan, northern lights from 9 to 9.20 p. m.

### REPORTS FROM U. S. LIFE-SAVING STATIONS.

Through the co-operation of the General Superintendent of the Life-Saving Service and the Secretary of the Treasury, the Weather Bureau has received monthly reports for the month of May from the keepers of 35 U. S. Life-Saving Stations on the Great Lakes.

## SUNSHINE AND CLOUDINESS.

### GENERAL REMARKS.

The quantity of sunshine, and therefore of heat, received by the atmosphere is a fundamental factor in the most important meteorological phenomena; the quantity received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends largely upon the distribution of cloudiness. The sunshine is now recorded automatically at about 38 regular stations of the Weather Bureau, either by its photographic or its thermal effects. The cloudiness is recorded by personal observations at all stations, and is given in the column of "average cloudiness" in Table I.

### SUNSHINE.

During the month an instrumental record of sunshine has been kept at 17 stations by means of the photographic sunshine recorder and at 21 stations by means of the thermometric sunshine recorder; the results of these observations are given in Table IV, for each hour of local mean time (not seventy-fifth meridian time). The stations recording the largest percentage of sunshine between the hours of 11 a. m. and 1 p. m., were: Des Moines and Galveston, 95; Salt Lake City, 93.5; Tucson, 91. The stations having the least percentage between these hours were Eastport, 47.5; Portland, Oreg., 50; Cleveland, 54.5. The general average percentage for the whole month is given in the next to the last column of Table IV. The highest percentages were: Tucson, 89; and Galveston, 88. The lowest percentages were: Eastport, 40; Rochester, 44; Portland, Oreg., 45.

### CLOUDINESS.

The average cloudiness between sunrise and sunset, as based on numerous personal observations, is given for each Weather Bureau station in Table I; the complement of this average cloudiness gives the observer's estimated percentage of clear sky, and these latter numbers are given in the last column of Table IV.

### COMPARISON OF SUNSHINE AND CLEAR SKY.

The sunshine registers give the duration of direct sunshine whence the percentage of possible sunshine is derived; the observer's personal estimates give the percentage of area of clear sky. It must not be assumed that these numbers should agree, and for comparative purposes they have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental record of duration of sunshine is almost always larger than the observer's personal estimate of percentages of area of clear sky; the average excess is 8 per cent for photographic records and 12 per cent for thermometric records:

*Difference between instrumental and personal observations of sunshine.*

| Photographic stations. | Instrumental. | Personal. | Difference. | Thermometric stations. | Instrumental. | Personal. | Difference. |
|---|---|---|---|---|---|---|---|
| Tucson, Ariz | 89 | 78 | 11 | Des Moines, Iowa | 78 | 69 | 9 |
| Galveston, Tex | 88 | 88 | 0 | Key West, Fla | 75 | 52 | 23 |
| Santa Fe, N. Mex | 77 | 63 | 14 | New Orleans, La | 72 | 72 | 0 |
| Bismarck, N. Dak | 72 | 68 | 4 | Little Rock, Ark | 69 | 41 | 28 |
| Dodge City, Kans | 71 | 63 | 8 | Salt Lake City, Utah | 69 | 57 | 12 |
| Kansas City, Mo | 71 | 56 | 15 | St. Louis, Mo | 66 | 56 | 10 |
| Savannah, Ga | 71 | 60 | 11 | Baltimore, Md | 65 | 52 | 13 |
| Denver, Colo | 63 | 46 | 17 | Chicago, Ill | 62 | 50 | 12 |
| San Francisco, Cal | 59 | 49 | 10 | Colorado Springs, Colo. | 62 | 41 | 11 |
| Washington, D. C | 59 | 51 | 8 | Columbus, Ohio | 61 | 40 | 21 |
| Cincinnati, Ohio | 56 | 47 | 9 | New Haven, Conn | 58 | 45 | 13 |
| Cleveland, Ohio | 54 | 40 | 14 | Boston, Mass | 57 | 46 | 11 |
| San Diego, Cal | 53 | 56 | — 3 | Louisville, Ky | 57 | 39 | 18 |
| Portland, Oreg | 45 | 45 | 0 | Philadelphia, Pa | 57 | 38 | 19 |
| Eastport, Me | 40 | 31 | 9 | Wilmington, N.C. | 57 | 60 | — 3 |
| Helena, Mont | ..... | ..... | ..... | Portland, Me | 55 | 35 | 20 |
| Memphis, Tenn | ..... | 61 | ..... | Detroit, Mich | 53 | 42 | 11 |
| | | | | Buffalo, N. Y | 52 | 46 | 12 |
| | | | | New York, N. Y | 49 | 41 | 8 |
| | | | | Rochester, N. Y | 43 | 35 | 9 |
| | | | | Vicksburg, Miss | ..... | 70 | ..... |

## NOTES BY THE EDITOR.

### REMARKABLE HAIL.

During a severe hailstorm at Vicksburg on the afternoon of Friday, May 11, a remarkably large hailstone was found to have a solid nucleus, consisting of a piece of alabaster from one-half to three-quarters of an inch. During the same storm at Bovina, 8 miles east of Vicksburg, a gopher turtle, 6 by 8 inches, and entirely encased in ice, fell with the hail.

An examination of the weather map shows that these hail storms occurred on the south side of a region of cold northerly winds, and were but a small portion of a series of similar storms; apparently some special local whirls or gusts carried heavy objects from the earth's surface up to the cloud region, where they were encased by successive layers of snow and ice, until they fell as hailstones. The fact that hailstones, as well as drops of water and flakes of snow, often contain nuclei that must have been carried up from the earth's surface, is entirely in accord with the general principle that ascending currents precede the formation of cloud and rain, and that solid nuclei are needed to initiate the ordinary precipitation of moisture.

## THE TEMPERATURE OF MAY AND OF THE YEAR.

In connection with an article published by a correspondent at Smiths Grove, Ky., giving an account of the remarkable weather of the year 1816, it has been suggested that there may be some connection between the temperature of any given month and the general temperature of the year, and that 1894 may be as cold a year as 1816, and that if this be the case, then a study of the temperatures of the month and the year during the past century may enable us to predict the annual mean when any monthly mean is known.

Following up this suggestion, which is not new to the European students of meteorology, the present editor desires to elucidate the subject by a study of the data at hand for some station in America; he, therefore, submits the following tables relative to Philadelphia and eastern Pennsylvania. Philadelphia is chosen partly because of its long record and partly on account of its position midway along the Atlantic coast. It is not likely that any specific rules deduced from Philadelphia would be rigorously applicable to stations far distant, north, south, or west, but in a general way it may be safely anticipated that the rules deduced for other stations will not be any more definite or more useful than those for this place.

The monthly and annual mean temperatures of any station show such a constancy, while the errors due to the thermometers, the hours of observations, the localities and methods of exposure are so large that it is always a matter of uncertainty whether in our study of the climate we are not being misled by the unknown errors of the instruments and methods.

In the accompanying Table 1 there are given the recorded mean temperatures of the month of May for each year, as also the annual temperatures and the departures of these temperatures from the respective normals for the years 1825 to 1888. All of these temperatures were observed at one place, namely, the Philadelphia Hospital, and are here quoted from p. 127 of the "Annual Report of the Secretary for Internal Affairs of the Commonwealth of Pennsylvania for 1888." No details are known as to the numerous changes of instruments, observers, and location during this long period.

TABLE 1.—*Philadelphia (Pa.) Hospital.*
Means: May, 63.6; annual, 53.7.

| Year. | Recorded temperatures. | | Departures. | | Year. | Recorded temperatures. | | Departures. | |
|---|---|---|---|---|---|---|---|---|---|
| | May. | Annual. | May. | Annual. | | May. | Annual. | May. | Annual. |
| | ° | ° | ° | ° | | ° | ° | ° | ° |
| 1825.. | 62.0 | 53.5 | −1.6 | −0.2 | 1857.. | 60.9 | 52.8 | −2.7 | −0.9 |
| 1826.. | 72.0 | 53.9 | +8.4 | +0.2 | 1858.. | 59.1 | 54.3 | −4.5 | +0.6 |
| 1827.. | 62.0 | 52.1 | −1.6 | −1.6 | 1859.. | 63.9 | 54.2 | +0.3 | +0.5 |
| 1828.. | 66.0 | 55.7 | +2.4 | +2.0 | 1860.. | 64.3 | 54.1 | +0.7 | +0.4 |
| 1829.. | 64.0 | 52.6 | +0.4 | −1.1 | 1861.. | 59.5 | 54.7 | −4.1 | +1.0 |
| 1830.. | 64.0 | 54.9 | +0.4 | +1.2 | 1862.. | 63.7 | 54.2 | +0.1 | +0.5 |
| 1831.. | 66.0 | 53.7 | +2.4 | 0.0 | 1863.. | 64.6 | 54.5 | +1.0 | +0.8 |
| 1832.. | 62.0 | 53.9 | −1.6 | +0.2 | 1864.. | 67.2 | 54.8 | +3.6 | +1.1 |
| 1833.. | 63.0 | 53.7 | −0.6 | 0.0 | 1865.. | 63.4 | 55.5 | −0.2 | +1.8 |
| 1834.. | 64.5 | 54.6 | +0.9 | +0.9 | 1866.. | 61.4 | 54.7 | −2.2 | +1.0 |
| 1835.. | 64.5 | 53.6 | +0.9 | −0.1 | 1867.. | 59.4 | 53.9 | −4.2 | +0.2 |
| 1836.. | 64.0 | 49.6 | +0.4 | −4.1 | 1868.. | 59.7 | 53.2 | −3.9 | −0.5 |
| 1837.. | 60.0 | 50.7 | −3.6 | −3.0 | 1869.. | 63.5 | 54.7 | −0.1 | +1.0 |
| 1838.. | 58.2 | 51.3 | −5.4 | −2.4 | 1870.. | 65.5 | 56.8 | +1.3 | +3.1 |
| 1839.. | 62.0 | 52.4 | −1.6 | −1.2 | 1871.. | 66.3 | 53.6 | +2.7 | −0.1 |
| 1840.. | 62.1 | 52.8 | −1.5 | −0.9 | 1872.. | 68.6 | 54.7 | +5.0 | +1.0 |
| 1841.. | 58.7 | 52.1 | −4.9 | −1.6 | 1873.. | 63.1 | 53.9 | −0.5 | +0.2 |
| 1842.. | 59.0 | 53.1 | −4.6 | −0.6 | 1874.. | 62.1 | 54.8 | −1.5 | +1.1 |
| 1843.. | 60.0 | 51.9 | −3.6 | −1.8 | 1875.. | 63.2 | 51.7 | −0.4 | −2.0 |
| 1844.. | 65.5 | 53.3 | +1.9 | −0.4 | 1876.. | 62.7 | 53.4 | −1.9 | −0.3 |
| 1845.. | 59.8 | 53.8 | −3.8 | +0.1 | 1877.. | 62.8 | 55.7 | −0.8 | +2.0 |
| 1846.. | 64.0 | 54.4 | +0.4 | +0.7 | 1878.. | 62.9 | 56.1 | −0.7 | +2.4 |
| 1847.. | 61.8 | 53.8 | −1.8 | +0.1 | 1879.. | 64.6 | 53.9 | +1.0 | +0.2 |
| 1848.. | 65.8 | 54.8 | +2.2 | +1.1 | 1880.. | 70.6 | 55.0 | +7.0 | +1.3 |
| 1849.. | 58.4 | 53.1 | −5.2 | −0.6 | 1881.. | 65.5 | 55.0 | +1.9 | +1.3 |
| 1850.. | 57.7 | 54.0 | −5.9 | +0.4 | 1882.. | 56.8 | 53.6 | −6.8 | −0.1 |
| 1851.. | 62.6 | 54.7 | −1.0 | +1.0 | 1883.. | 62.2 | 52.5 | −1.4 | −1.2 |
| 1852.. | 63.3 | 53.6 | −0.3 | −0.1 | 1884.. | 60.3 | 53.4 | −3.3 | −0.3 |
| 1853.. | 63.5 | 54.9 | −0.1 | +1.2 | 1885.. | 60.4 | 52.6 | −3.2 | −1.1 |
| 1854.. | 64.7 | 54.7 | +1.1 | +1.0 | 1886.. | 61.3 | 52.6 | −2.3 | −1.1 |
| 1855.. | 61.5 | 53.6 | −2.1 | −0.1 | 1887.. | 67.2 | 53.2 | +3.6 | −1.5 |
| 1856.. | 60.0 | 52.0 | −3.6 | −1.7 | 1888.. | 60.9 | 52.0 | −2.7 | −1.7 |

Table 2 gives similar data for the years 1790 to 1886 for Morrisville and Fallsington. This record is quoted from the same volume, p. 34, and is made up of several parts, viz: Morrisville, by C. Pierce, 1790 to 1859; Fallsington, by E. Hance, 1860 to 1875, and M. Gillingham, 1879 to 1886. Morrisville and Fallsington are on the west side of the Delaware River, near Trenton, and about 25 miles northeast of the Philadelphia Hospital; therefore, their general climatic conditions differ but little from those of Philadelphia.

TABLE 2.—*Observations at Morrisville and Fallsington, Pa.*
Means: May, 62.0; annual, 51.9.

| Year. | Temperature observations. | | Departures. | | Year. | Temperature observations. | | Departures. | |
|---|---|---|---|---|---|---|---|---|---|
| | May. | Annual. | May. | Annual. | | May. | Annual. | May. | Annual. |
| | ° | ° | ° | ° | | ° | ° | ° | ° |
| 1790.. | 56.0 | 52.0 | −6.0 | +0.1 | 1840.. | 61.0 | 52.3 | −1.0 | +0.4 |
| 1791.. | 58.0 | 53.2 | −4.0 | +1.3 | 1841.. | 58.0 | 51.7 | −4.0 | −0.2 |
| 1792.. | 58.0 | 51.5 | −4.0 | −0.4 | 1842.. | 60.0 | 52.8 | −2.0 | +0.9 |
| 1793.. | 62.0 | 53.8 | 0.0 | +1.9 | 1843.. | 58.0 | 51.6 | −4.0 | −0.3 |
| 1794.. | 66.0 | 50.1 | +4.0 | −1.8 | 1844.. | 65.0 | 53.1 | +3.0 | +1.2 |
| 1795.. | 68.0 | 51.4 | +6.0 | −0.5 | 1845.. | 54.0 | 53.9 | −8.0 | +2.0 |
| 1796.. | 64.0 | 51.7 | +2.0 | −0.2 | 1846.. | 62.0 | 53.5 | 0.0 | +1.6 |
| 1797.. | 64.0 | 51.2 | +2.0 | −0.7 | 1847.. | | | | |
| 1798.. | 65.0 | 51.7 | +3.0 | −0.2 | 1848.. | | | | |
| 1799.. | 68.0 | 51.1 | +6.0 | −0.8 | 1849.. | 56.3 | 50.8 | −5.7 | −1.1 |
| 1800.. | 70.0 | 51.4 | +8.0 | −0.5 | 1850.. | 56.5 | 51.8 | −5.5 | −0.1 |
| 1801.. | 66.0 | 52.0 | +4.0 | +0.1 | 1851.. | 59.5 | 50.9 | −2.5 | −1.0 |
| 1802.. | 71.0 | 53.8 | +9.0 | +1.9 | 1852.. | 59.3 | 50.0 | −2.7 | −1.9 |
| 1803.. | 60.0 | 51.8 | −2.0 | −0.1 | 1853.. | 61.6 | 51.7 | −0.4 | −0.2 |
| 1804.. | 62.0 | 51.2 | 0.0 | −0.7 | 1854.. | 62.2 | 51.4 | +0.2 | −0.5 |
| 1805.. | 63.0 | 51.6 | +1.0 | −0.3 | 1855.. | 59.7 | 50.5 | −2.3 | −1.4 |
| 1806.. | 67.0 | 51.5 | +5.0 | −0.4 | 1856.. | 57.4 | 49.3 | −4.6 | −2.6 |
| 1807.. | 65.0 | 52.0 | +3.0 | +0.1 | 1857.. | 57.7 | 49.6 | −4.3 | −2.3 |
| 1808.. | 62.0 | 52.8 | 0.0 | +0.9 | 1858.. | 56.7 | 51.5 | −5.3 | −0.4 |
| 1809.. | 60.0 | 51.2 | −2.0 | −0.7 | 1859.. | 61.0 | 50.6 | −1.0 | −1.3 |
| 1810.. | 58.0 | 51.0 | −4.0 | −0.9 | | | | | |
| 1811.. | 62.0 | 52.1 | 0.0 | +0.2 | 1860.. | 60.3 | 50.8 | −1.7 | −1.1 |
| 1812.. | 60.0 | 51.0 | −2.0 | −0.9 | 1861.. | 56.0 | 52.0 | −6.0 | +0.1 |
| 1813.. | 59.0 | 50.5 | −3.0 | −1.4 | 1862.. | 60.6 | 51.3 | −1.4 | −0.6 |
| 1814.. | 62.0 | 51.0 | 0.0 | −0.9 | 1863.. | 61.4 | 51.6 | −0.6 | −0.3 |
| 1815.. | 64.0 | 51.3 | +2.0 | −0.6 | 1864.. | 65.7 | 52.4 | +3.7 | +0.5 |
| 1816.. | 57.0 | 48.8 | −5.0 | −3.1 | 1865.. | 62.0 | 53.0 | 0.0 | +1.1 |
| 1817.. | 65.0 | 52.7 | +3.0 | +0.8 | 1866.. | 59.0 | 52.4 | −3.0 | +0.5 |
| 1818.. | 62.0 | 52.8 | 0.0 | +0.9 | 1867.. | 56.7 | 51.6 | −5.3 | −0.3 |
| 1819.. | 60.0 | 51.2 | −2.0 | −0.7 | 1868.. | 57.3 | 50.4 | −4.7 | −1.5 |
| 1820.. | 62.0 | 51.7 | 0.0 | −0.2 | 1869.. | 59.7 | 51.7 | −2.3 | −0.2 |
| 1821.. | 65.0 | 51.5 | +3.0 | −0.4 | 1870.. | 63.3 | 54.3 | +1.3 | +2.4 |
| 1822.. | 70.0 | 53.2 | +8.0 | +1.3 | 1871.. | 63.0 | 52.1 | +1.0 | +0.2 |
| 1823.. | 64.0 | 53.5 | +2.0 | +1.6 | 1872.. | 65.7 | 52.2 | +3.7 | +0.3 |
| 1824.. | 67.0 | 53.6 | +5.0 | +1.7 | 1873.. | 60.7 | 51.8 | −1.3 | −0.1 |
| 1825.. | 62.0 | 54.0 | 0.0 | +2.1 | 1874.. | 61.7 | 53.2 | −0.3 | +1.3 |
| 1826.. | 71.0 | 53.0 | +9.0 | −0.9 | 1875.. | 64.3 | 51.8 | +2.3 | −0.1 |
| 1827.. | 62.0 | 50.3 | 0.0 | −1.6 | | | | | |
| 1828.. | 65.0 | 56.3 | +3.0 | +4.4 | 1876.. | | | | |
| 1829.. | 64.0 | 53.0 | +2.0 | +1.1 | 1877.. | | | | |
| 1830.. | 64.0 | 52.5 | +2.0 | +0.6 | 1878.. | | | | |
| 1831.. | 66.0 | 53.0 | +4.0 | +1.1 | 1879.. | 63.2 | 52.1 | +1.2 | +0.2 |
| 1832.. | 62.0 | 50.2 | 0.0 | −1.7 | 1880.. | 68.2 | 53.3 | +6.2 | +1.4 |
| 1833.. | 63.0 | 52.6 | +1.0 | +0.7 | 1881.. | 64.3 | 53.8 | +2.3 | +1.9 |
| 1834.. | 64.0 | 52.4 | +2.0 | +0.5 | 1882.. | 56.3 | 52.5 | −5.7 | +0.6 |
| 1835.. | 64.0 | 52.2 | +2.0 | +0.3 | 1883.. | 53.0 | 50.5 | −9.0 | −1.4 |
| 1836.. | 63.0 | 50.2 | +1.0 | −1.7 | 1884.. | 61.2 | 52.1 | −0.8 | +0.2 |
| 1837.. | 61.0 | 52.3 | −1.0 | +0.4 | 1885.. | 57.2 | 49.0 | −4.8 | −2.9 |
| 1838.. | 58.0 | 52.3 | −4.0 | +0.4 | 1886.. | 58.2 | 49.7 | −3.8 | −2.2 |
| 1839.. | 62.0 | 52.0 | 0.0 | +0.1 | | | | | |

If we adopt 63.6° and 53.7° as the mean temperatures for May and for the year, respectively, in Table 1 for Philadelphia and take the departures of the individual monthly and annual figures from these normals, we obtain the positive and negative departures given in Table 1. Similarly, if we adopt 62.0° and 51.9° as the normal temperatures for May and for the year for the combined stations in Table 2, we obtain the departures given in that table.

If now we group these departures by limits of 1° each we obtain the number of times that each departure occurs, as shown in Table 3. The systematic arrangement of these departures (being most numerous in the neighborhood of 0 and least numerous at a greater distance therefrom) shows that on the average of the century there are about as many warm months and years as there are cold ones.

When a positive departure for May occurs simultaneously with a positive departure for the year we have to count that year as favoring the hypothesis that a warm May coincides with, and therefore, to a certain extent, presages a warm year. Similarly, when a negative departure for May coincides with a negative departure for that year it corroborates

the general rule that warm or cold Mays presage warm or cold years, respectively.

TABLE 3.

| Departures. | Frequency at— Philadelphia. May. | Philadelphia. Year. | Morrisville and Fallsington. May. | Morrisville and Fallsington. Year. | Departures. | Frequency at— Philadelphia. May. | Philadelphia. Year. | Morrisville and Fallsington. May. | Morrisville and Fallsington. Year. |
|---|---|---|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | | ° | ° | ° | ° |
| +9.5 to +8.6 | 0 | 0 | 2 | 0 | −1.5 to −2.4 | 11 | 8 | 7 | 8 |
| +8.5 to +7.6 | 1 | 0 | 2 | 0 | −2.5 to −3.4 | 4 | 1 | 5 | 3 |
| +7.5 to +6.6 | 1 | 0 | 0 | 0 | −3.5 to −4.4 | 7 | 1 | 8 | 1 |
| +6.5 to +5.6 | 0 | 0 | 3 | 0 | −4.5 to −5.4 | 5 | 0 | 6 | 0 |
| +5.5 to +4.6 | 1 | 0 | 2 | 0 | −5.5 to −6.4 | 1 | 0 | 5 | 0 |
| +4.5 to +3.6 | 2 | 0 | 5 | 1 | −6.5 to −7.4 | 1 | 0 | 0 | 0 |
| +3.5 to +2.6 | 1 | 1 | 6 | 0 | −7.5 to −8.4 | 0 | 0 | 1 | 0 |
| +2.5 to +1.6 | 5 | 4 | 10 | 9 | −8.5 to −9.4 | 0 | 0 | 1 | 0 |
| +1.5 to +0.6 | 6 | 19 | 7 | 18 | Total ..... | 64 | 64 | 92 | 92 |
| +0.5 to −0.4 | 11 | 20 | 15 | 31 | | | | | |
| −0.5 to −1.4 | 7 | 10 | 7 | 21 | | | | | |

TABLE 4.

| Correlate departures. May. | Correlate departures. Year. | No. of cases. Phil. May. | No. of cases. M. & F. Year. | General result. | Correlate departures. May. | Correlate departures. Year. | No. of cases. Phil. | No. of cases. M. & F. | General result. |
|---|---|---|---|---|---|---|---|---|---|
| + | + | 16 | 22 | Favorable, 91. | + | 0 | 1 | 1 | Neutral. 15. |
| − | − | 23 | 30 | | − | 0 | 1 | 1 | |
| + | − | 6 | 15 | Unfavorable, 50. | 0 | + | 0 | 9 | |
| − | + | 17 | 12 | | 0 | − | 0 | 3 | |
| | | | | | 0 | 0 | 0 | 0 | |

Table No. 4 shows the number of cases that agree, or oppose, or are neutral, with respect to this rule, and the sum total shows that we have 91 favorable cases, 50 unfavorable, and 15 neutral. There is, therefore, only a very slight probability in favor of the general application of the rule.

OBSERVATIONS AT HONOLULU, HAWAIIAN ISLANDS.

As the weather on the Pacific coast depends so largely upon the conditions of the atmosphere to the westward, it is considered important to publish in full and as soon as practicable the data furnished by observers in Alaska, the Sandwich Islands, and adjacent regions.

*Meteorological observations at Honolulu, Hawaiian Islands, for May, 1894, by Curtis J. Lyons, Meteorologist to the Government Survey.*

| Date. | Barometer at sea level. 9 a. m. | 3 p. m. | 9 p. m. | Temperature. 6 a. m. | 2 p. m. | 9 p. m. | Minimum. | Maximum. | Humidity. Relative. 9 a.m. | 9 p.m. | Absolute. | Wind. Direction. | Force. | Cirrus cloud moving from— | Rain to 6 a. m. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Ins.* | *Ins.* | *Ins.* | ° | ° | ° | ° | ° | % | % | | | | | *Ins.* |
| 1 .. | 30.10 | 30.02 | 30.08 | 72 | 76 | 74 | 72 | 80 | 70 | 75 | 6.6 | ne.,s., e. | 3, 1 | ..... | 0.00 |
| 2 .. | 30.10 | 30.03 | 30.08 | 72 | 79 | 71 | 69 | 82 | 67 | 76 | 6.5 | ne. | 3 | ..... | 0.00 |
| 3 .. | 30.04 | 29.90 | 30.04 | 66 | 79 | 74 | 64 | 81 | 67 | 74 | 6.9 | e., s. | 2 | ..... | 0.00 |
| 4 .. | 30.06 | 30.00 | 30.12 | 67 | 77 | 72 | 66 | 80 | 73 | 85 | 7.3 | s., n. | 0 | ..... | 0.00 |
| 5 .. | 30.08 | 30.00 | 30.05 | 73 | 79 | 71 | 71 | 80 | 75 | 85 | 6.9 | e., s., ne | 2 | ..... | 0.02 |
| 6 .. | 30.03 | 29.98 | 30.04 | 69 | 76 | 73 | 65 | 80 | 66 | 67 | 6.3 | ne. | 3 | ..... | 0.00 |
| 7 .. | 30.04 | 30.01 | 30.10 | 70 | 77 | 73 | 66 | 80 | 67 | 70 | 6.2 | ne. | 3 | ..... | 0.00 |
| 8 .. | 30.13 | 30.08 | 30.16 | 71 | 79 | 73 | 70 | 79 | 67 | 74 | 6.6 | ne. | 3, 5 | ..... | 0.01 |
| 9 .. | 30.18 | 30.10 | 30.15 | 71 | 78 | 74 | 69 | 79 | 67 | 78 | 6.3 | ne. | 4 | ..... | 0.06 |
| 10 .. | 30.12 | 30.08 | 30.14 | 71 | 79 | 73 | 71 | 81 | 71 | 70 | 6.6 | ne. | 4 | ..... | 0.03 |
| 11 .. | 30.13 | 30.09 | 30.15 | 72 | 78 | 73 | 72 | 80 | 59 | 70 | 6.1 | ene. | 4 | ..... | 0.01 |
| 12 .. | 30.18 | 30.14 | 30.22 | 72 | 76 | 74 | 71 | 80 | 66 | 73 | 6.3 | ne. | 5 | ..... | 0.01 |
| 13 .. | 30.26 | 30.20 | 30.27 | 72 | 78 | 72 | 72 | 79 | 65 | 69 | 6.1 | ne. | 4 | ..... | 0.00 |
| 14 .. | 30.26 | 30.20 | 30.25 | 72 | 77 | 72 | 71 | 78 | 63 | 65 | 5.7 | ne. | 3 | ..... | 0.00 |
| 15 .. | 30.21 | 30.13 | 30.18 | 70 | 78 | 72 | 67 | 79 | 57 | 68 | 5.7 | ne. | 3 | ..... | 0.00 |
| 16 .. | 30.17 | 30.07 | 30.16 | 71 | 77 | 72 | 69 | 78 | 65 | 69 | 5.8 | ne. | 4 | ..... | 0.01 |
| 17 .. | 30.13 | 30.07 | 30.13 | 71 | 75 | 71 | 69 | 78 | 65 | 75 | 6.1 | nne. | 3, 5, 2 | ..... | 0.01 |
| 18 .. | 30.14 | 30.09 | 30.16 | 71 | 77 | 70 | 69 | 79 | 67 | 83 | 6.2 | ne. | 3 | ..... | 0.03 |
| 19 .. | 30.13 | 30.10 | 30.13 | 71 | 74 | 72 | 68 | 76 | 73 | 69 | 6.2 | nne. | 4 | ..... | 0.13 |
| 20 .. | 30.12 | 30.07 | 30.10 | 71 | 77 | 72 | 71 | 80 | 61 | 70 | 6.1 | ne. | 4, 2 | s.40 w. | 0.00 |
| 21 .. | 30.12 | 30.05 | 30.14 | 72 | 78 | 68 | 67 | 81 | 68 | 70 | 6.1 | ne. | 3 | ..... | 0.00 |
| 22 .. | 30.13 | 30.07 | 30.12 | 65 | 79 | 73 | 64 | 82 | 71 | 73 | 6.3 | nne. | 2 | s.10 w. | 0.00 |
| 23 .. | 30.00 | 30.02 | 30.07 | 70 | 78 | 69 | 69 | 80 | 74 | 87 | 7.3 | w., n. | 2 | ..... | 0.00 |
| 24 .. | 30.03 | 30.00 | 30.07 | 70 | 78 | 69 | 67 | 81 | 77 | 85 | 7.5 | s., sw. | 2 | ..... | 0.04 |
| 25 .. | 30.07 | 30.01 | 30.10 | 65 | 80 | 72 | 65 | 83 | 62 | 80 | 6.8 | n., e., s. | 2 | s.30 w. | 0.03 |
| 26 .. | 30.11 | 30.08 | 30.16 | 67 | 79 | 74 | 66 | 81 | 74 | 70 | 6.3 | ne. | 3 | ..... | 0.00 |
| 27 .. | 30.17 | 30.14 | 30.22 | 72 | 80 | 75 | 70 | 82 | 60 | 70 | 6.4 | ne. | 3 | s.40 w. | 0.00 |
| 28 .. | 30.21 | 30.15 | 30.23 | 74 | 80 | 75 | 73 | 82 | 60 | 67 | 6.2 | ne. | 3, 5 | s.30 w. | 0.00 |
| 29 .. | 30.22 | 30.14 | 30.21 | 74 | 79 | 75 | 73 | 82 | 63 | 69 | 6.4 | ene. | 5 | s.10 w. | 0.01 |
| 30 .. | 30.19 | 30.13 | 30.18 | 74 | 79 | 75 | 73 | 81 | 63 | 68 | 6.4 | ne. | 5 | s.40 w. | 0.00 |
| 31 .. | 30.18 | 30.10 | 30.17 | 74 | 80 | 75 | 74 | 81 | 61 | 69 | 6.3 | ne. | 5 | ..... | 0.00 |
| Mean. | 30.132 | 30.075 | 30.141 | 70.7 | 77.9 | 72.5 | 69.1 | 80.3 | 66.6 | 72.8 | 6.4 | | 3.3 | | 0.40 |
| | | 30.103 | | | 73.7 | | 74.7 | | 69.7 | | | | | | |

The barometer is corrected for temperature and reduced to sea level, but the gravity correction, −0.06, is still to be applied.

The absolute humidity is expressed in grains of water, per cubic foot, and is the average of four observations.

The rain is measured at 6 a. m., daily.

The extremes of the force of the wind are given when it has varied more than usual.

## METEOROLOGICAL TABLES.

[*Prepared by the Division of Records and Meteorological Data.*]

The following pages present in tabular form the climatological data for the current month, on which the text of the preceding part of this REVIEW has, to a large extent, been based.

For a detailed description of the methods of observation, compilation, and computation relating to these tables, the reader is referred to page 129 of the MONTHLY WEATHER REVIEW for March, 1894. The general contents of the tables are as follows:

Table I gives for 140 Weather Bureau stations, making two observations daily, and for 10 others making only one observation, the ordinary climatological data.

Table II gives for about 2,200 stations, occupied by voluntary observers, the mean and extreme temperatures and the total precipitation.

Table III gives for about 30 Canadian stations the climatological data.

Table IV gives for 38 Weather Bureau stations the percentages of sunshine for each hour of local mean time.

Table V gives for 81 stations the mean temperatures for each hour of seventy-fifth meridian time.

Table VI gives for 66 stations the mean pressures for each hour of seventy-fifth meridian time.

Table VII gives for 138 stations the mean hourly movement of the wind.

Table VIII gives for 68 stations the resultant movements and directions of the wind from continuous registrations.

Table IX gives for 140 stations the component and resultant directions based on simultaneous observations at 8 a. m. and 8 p. m., seventy-fifth meridian time.